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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/683,801	10/10/2003	Paul A. Morgan	MI22-2411	2171
21567	7590	03/11/2004	EXAMINER	
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			NGUYEN, HA T	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 03/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/683,801

Applicant(s)

MORGAN, PAUL A.

Examiner

Ha T. Nguyen

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) ____ is/are pending in the application.
4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 10 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 10-10-03.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-7 are rejected under 35 U.S.C. as being 103(a) as being unpatentable over Kwag et al., U. S. Patent 6232228 B1(hereinafter Kwag).

As to claim 1, referring to figs. 12-17, Kwag discloses in an embodiment a semiconductor processing method of cleaning a surface of a copper-containing material, comprising: forming the copper-containing material 232 over a semiconductor substrate 220; and exposing the surface of the copper-containing material to an acidic mixture comprising NO_3^- and F^- (see col. 12, lines 7-27). But it does not disclose expressly the use of a mixture comprising Cl^- , NO_3^- and F. However, the missing limitation is well known in the art because Kwag also discloses the use of an etching composition including at least one oxidant, HNO_3 among others, and at least an enhancer selected from HF, HCl and others (See abstract).

As to claim 2, Kwag discloses that the copper-containing material consists of elemental copper, the examiner interprets copper to be elemental copper because no impurity is indicated (see col. 11, lines 32-33 and col. 10, lines 54-57).

As to claims 3-4, Kwag discloses in the case of acidic HNO_3 , HCl, and HF mixture in deionized water, the mixture is an aqueous mixture comprising non-aqueous components, and wherein the non-aqueous components consist essentially of Cl^- ; NO_3^- , F^- , at least until the exposing, and the only non-hydroxide anions in the mixture consist essentially of Cl^- ; NO_3^- , F^- , note that in water the acids produce the anions Cl^- ; NO_3^- , F and H^+ ions which form with a corresponding number of water molecule to form H_3O^+ , left over H_2O molecules form the balance of the mixture (see abstract and col. 12, lines 7-27).

As to claim 5, Kwag discloses substantially the limitations of claim 5, as shown above. But it does not disclose expressly the claimed duration of the exposing. However, this would

Art Unit: 2812

have been obvious in light of Kwag because Kwag discloses that the processing time varies with the amount of material to be removed (see col. 12, lines 33-42).

As to claim 6, Kwag discloses substantially the limitations of claim 6, as shown above. But it does not disclose expressly that the exposing removes one or more of a copper oxide, a silicon oxide and a copper fluoride from the surface. However, in Kwag, not only the exposing removes copper, it also removes copper oxide inherently existed on the surface of the copper, an easily oxidized material because of its exposure to air, an oxidizing atmosphere.

As to claim 7, Kwag discloses that the exposing occurs at a temperature of from about 10C to about 40C (see col. 12, lines 23-27).

Therefore, it would have been obvious to use Kwag's teaching to obtain the invention as specified in claims 1-7.

3. Claims 8-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kwag in view of Donnelly, Jr. et al., U.S. Patent 6143658 (hereinafter Donnelly).

As to claims 8, 14 and 20, referring to figs. 12-17, Kwag discloses in an embodiment a semiconductor processing method of forming an opening to a copper-containing substrate, comprising: providing a copper-containing substrate 222 (see col. 10, lines 54-57 and col. 11, lines 29-39) having a mass 224 thereover, the mass comprising at least one of a silicon nitride and a silicon oxide (see col. 11, lines 29-32), the copper-containing substrate being supported by a semiconductor material 220; etching an opening through the mass and to the copper-containing substrate, a surface of the copper-containing substrate forming a base of the opening and thus defining a base surface of the opening; etching a surface of a copper-containing material 232 by exposing the surface of the copper-containing material to an acidic mixture comprising HNO_3 and HF (col. 12, lines 7-27). But it does not disclose expressly the use of an etching (cleaning) mixture comprising HNO_3 , HCl, and HF, that the base surface is at least partially covered by at least one of a copper oxide, a silicon oxide or a copper fluoride and the cleaning of said base surface with a HNO_3 , HCl, and HF acidic solution to remove at least some of the at least one of a copper oxide, a silicon oxide or a copper fluoride from the base surface; and the amount of material etched on the sidewalls of the opening. However, the missing limitations are well known in the art because Kwag also discloses the use of an etching composition includes at one

Art Unit: 2812

oxidant, HNO_3 among others, and at least an enhancer selected from HF , HCl and others (See abstract); and Donnelly discloses in figs. 6A-6 E, the cleaning of a contact hole on copper wire 640, the copper wire is covered at least partially with at least copper oxide, and the cleaning removes at least copper oxide (See col. 6, lines 6-25). A person of ordinary skill is motivated to modify Kwag with Donnelly because when using Donnelly's contact hole cleaning step in the process of Kwag, better contact between the plug and the lower wiring layer can be obtained, this would reduce contact resistance and increase contact reliability. The combined teaching of Kwag and Donnelly does not disclose any removed thickness. However any variation in removed thickness in the present claims is obvious in light of the cited art, because the changes in removed thickness produce no unexpected function. The routine varying of parameters to produce expected changes are within the ability of one of ordinary skill in the art. Patentability over the prior art will only occur if the parameter variation produces an unexpected result. In re Aller, Lacey and Hall, 105 U.S.P.Q. 233, 235. In re Reese 129 U.S.P.Q. 402, 406.

As to claims 15 and 21, Kwag discloses substantially the limitations of claims 15 and 21, as shown above. But it does not disclose expressly that the mass comprises at least two layers stacked atop one another, one of the at least two layers comprising the silicon oxide and the other of the at least two layers comprising the silicon nitride; and wherein the opening is etched through both of the at least two layers. However, these are well known in the art because Donnelly discloses these features (See fig. 6B and related text). A person of ordinary skill is motivated to modify Kwag with Donnelly because when using Donnelly's double layer mass in the process of Kwag, diffusion of copper can be prevented (see Donnelly, col. 2, lines 37-42).

As to claims 16 and 22, the combined teaching of Kwag and Donnelly discloses substantially the limitations of claims 16 and 22, as shown above. But it does not disclose expressly that cleaning removes substantially all of the contaminants (copper oxide). However, it would have been obvious to a person of ordinary skill in the art to have the cleaning removes substantially all the contaminants in order to have lower contact resistance.

As to claims 17 and 23, Kwag discloses that the copper-containing material consists of elemental copper (see col. 11, lines 32-33 and col. 10, lines 54-57).

As to claims 9, 10, 18-19 and 24-25, Kwag discloses in the case of acidic HNO_3 , HCl , and HF mixture in deionized water, the mixture is an aqueous mixture comprising non-aqueous

Art Unit: 2812

components, and wherein the non-aqueous components consist essentially of Cl^- ; NO_3^- , F^- , at least until the exposing, and the only non-hydroxide anions in the mixture consist essentially of Cl^- ; NO_3^- , F^- , note that in water the acids dissociate to produce the anions Cl^- ; NO_3^- , F^- and H^+ ions which form with a corresponding number of water molecule to form H_3O^+ , left over H_2O molecules form the balance of the mixture (see abstract and col. 12, lines 7-27).

As to claims 11, 12, and 26, the combined teaching of Kwag and Donnelly discloses substantially the limitations of claim 26, as shown above. But it does not disclose expressly the use of a mixture comprising HNO_3 , HCl , and HF with the claimed composition. However, the use of a HNO_3 , HCl , and HF mixture is well known in the art because Kwag also discloses the use of an etching composition includes at one oxidant, HNO_3 among others, and at least an enhancer selected from HF , HCl and others (See abstract). Kwag does not disclose the claimed mixture composition. However any variation in composition in the present claims is obvious in light of the cited art, because the changes in composition produce no unexpected function. The routine varying of parameters to produce expected changes are within the ability of one of ordinary skill in the art. Patentability over the prior art will only occur if the parameter variation produces an unexpected result. In re Aller, Lacey and Hall, 105 U.S.P.Q. 233, 235. In re Reese 129 U.S.P.Q. 402, 406.

As to claim 23, arguments used for the rejection of claim 6 also apply.

Therefore, it would have been obvious to combine Kwag with to obtain the invention as specified in claims 8-26.

Double Patenting Rejection

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

I. Claims 1-26 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-7 of U.S. Patent No. 6653243. Although the conflicting claims are not identical, they are not patentably distinct from each other because the claims of the application recite limitations of claims 1-7 but with broader scope (specifically claims 1 and 8 of the application correspond to claim 1 of the patent, and claims 14 and 20 to claim 2 etc.).

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (571) 272-1678. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week. The telephone number for Wednesday is (703) 560-0528.

Art Unit: 2812

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Neibling, can be reached on (571) 272-1679. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.



Ha Nguyen

Primary Examiner

03- 5- 04